

## New and newly recorded species of the subgenus *Flagellozetes* (*Cosmogalumna*) (Acari: Oribatida: Galumnidae) from China

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**Abstract:** One new species in the subgenus *Flagellozetes* (*Cosmogalumna*), *Flagellozetes* (*Cosmogalumna*) *macroporosa* sp. nov., is described from soil and leaf litter samples in Shaanxi and Guizhou Provinces, China. It is morphologically most similar to *Flagellozetes* (*Cosmogalumna*) *vladopesici* Ermilov & Corpuz-Raros, 2015, but differs by the absence of reticulate pattern on pteromorphs, middle part of prodorsum with irregular tubercles and the presence of a large median pore. The species *Flagellozetes* (*Cosmogalumna*) *ornata* Aoki, 1988 is recorded in China for the first time.

**Key words:** soil mites; taxonomy; distribution

中国广翼甲螨亚属一新种及一新纪录种（蜱螨亚纲：甲螨亚目：大翼甲螨科）

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**摘要:** 记述采自中国陕西省和贵州省的广翼甲螨亚属 *Flagellozetes* (*Cosmogalumna*) 1 新种。该新种与分布在菲律宾的弗拉基米尔广翼甲螨 *Flagellozetes* (*Cosmogalumna*) *vladopesici* Ermilov & Corpuz-Raros, 2015 相似, 但区别在于: 翅形体上不具有多边形网状结构; 前背板中部具有不规则的突节; 后背板中央孔明显。首次记录瑕饰广翼甲螨 *Flagellozetes* (*Cosmogalumna*) *ornata* Aoki, 1988 在中国的分布。

**关键词:** 土壤螨类; 分类; 分布

### Introduction

The family Galumnidae Jacot, 1925 includes 29 genera, 14 subgenera, 551 species and 33 subspecies (Subías 2004; updated 2018). Aoki (1988) proposed *Cosmogalumna* as a new genus based on the presence of notogastral polygonal sculpture. Previously *Cosmogalumna* has been included as a subgenus of *Galumna* (Subías 2004; Aoki 2009; Ermilov & Corpuz-Raros 2015) with *Variogalumna* being a junior subjective synonym of *Galumna* (*Cosmogalumna*) (Subías, 2004). However, Ermilov and Klimov think that the subgenus *Galumna* (*Cosmogalumna*) and the genus *Variogalumna* should be treated as subgenera of

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*Flagellozetes* by phylogenetic analysis (Ermilov & Klimov 2017). Currently, this subgenus comprises 13 species, which are distributed in Oriental, Neotropic and Palearctic Regions (Subías 2004; updated 2018).

At present, only one species in *Flagellozetes* (*Cosmogalumna*) was known in the Chinese oribatid mite fauna (Chen *et al.* 2010). The identification key to all species of this subgenus was provided by Ermilov and Corpuz-Raros (2015).

During field surveys of oribatid mites from China, we found three species of the subgenus *Flagellozetes* (*Cosmogalumna*); one species is new to science and another is recorded in China for the first time. The primary goal of this paper is to describe and illustrate the new species. The secondary goal is to record the distribution of the species *Flagellozetes* (*Cosmogalumna*) *ornata* Aoki, 1988 and *Flagellozetes* (*Cosmogalumna*) *praeoccupata* Subías, 2004.

## Material and methods

Soil sample were collected by soil-corer and afterwards extracted using Tullgren funnels. Measurements and descriptions are based on specimens mounted in temporary cavity slides and studied using a light microscope equipped with a drawing tube. All body measurements are presented in micrometers. The body length was measured in lateral view, from the tip of the rostrum to the posterior edge of the ventral plate, to avoid discrepancies caused by different degrees of notogastral distension. Notogastral width refers to the maximum width in dorsal aspect. Lengths of body setae were measured in lateral aspect. Formulas for leg setation are given in parentheses according to the sequence trochanter–femur–genu–tibia–tarsus (famulus included). Formulas for leg solenidia are given in square brackets according to the sequence genu–tibia–tarsus. General terminology used in this paper follows that of Grandjean as summarized by Norton and Behan-Pelletier (2009). In the figures and text, we use the following abbreviations: rostral setae (*ro*), lamellar setae (*le*), interlamellar setae (*in*), exobothridial setae (*ex*), sensillus (*ss*), dorsophragmata (*D*), prodorsal porose areas (*Ad*), notogastral porose areas (*Aa*, *A<sub>1</sub>*, *A<sub>2</sub>*, *A<sub>3</sub>*), notogastral setae (*c*, *la*, *lm*, *lp*, *h*-, *p*-series), lyrifissure (*ia*, *im*, *ip*, *ih*, *ips*), opisthonotal gland openings (*gla*), median pore (*mp*), subcapitular setae (*a*, *h*, *m*), cheliceral setae (*cha*, *chb*), adoral setae (*or*), epimeral setae (*a*-, *b*-, *c*-series), adanal and anal setae (*ad*-, *an*-series), genital setae (*g<sub>1</sub>*–*g<sub>6</sub>*), aggenital setae (*ag*), adanal lyrifissure (*iad*), postanal porose (*Ap*). All type specimens are kept in alcohol and deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC).

## Taxonomy

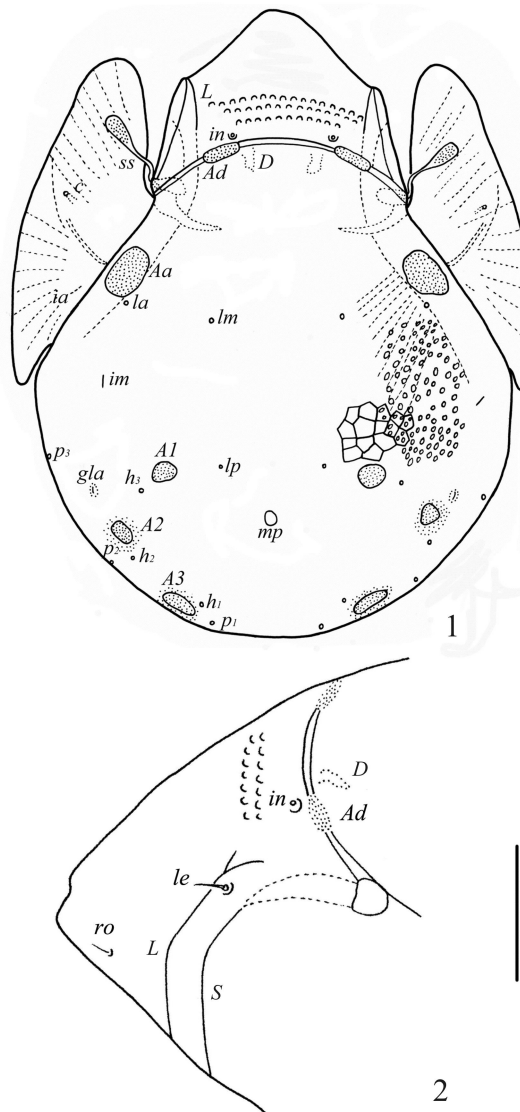
### *Flagellozetes* (*Cosmogalumna*) Aoki, 1988

#### *Flagellozetes* (*Cosmogalumna*) *macroporosa* sp. nov. (Figs. 1–11)

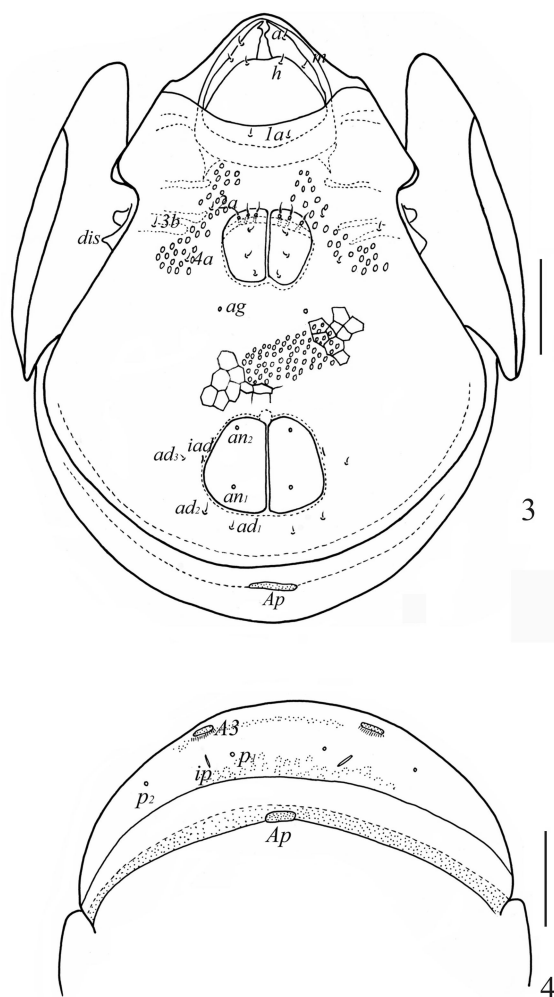
Diagnosis. Middle part of prodorsum with irregular tubercles, pteromorphae without polygonal network, only middle part of notogaster covered by polygonal network. Rostral and lamellar setae thin, smooth. Interlamellar setae represented by alveoli. Sensillus with long stalk and oval distal head, which is covered by several minute barbs. Anterior notogastral margin developed. Four pairs of porose areas larger, oval or rounded. Median pore present.

Postanal porose area elongated oval. Tridactylous.

Description. Dimensions. Body length 335 (holotype: female), 305–350 (eighteen paratypes, ten females, eight males); notogaster width: 254 (holotype), 249–260 (paratypes). Prodorsum setae: *ro*, 8–10, *le*, 9–11, *ss*, 38–46, stalk 18–22 and head 20–24, porose areas: *Ad* 20–24 × 5–8, *Aa* 15–18 × 27–30, *A*<sub>1</sub> diameter: 12–14, *A*<sub>2</sub> 8–10 × 12–14, *A*<sub>3</sub> 6–8 × 20–23, *Ap* 25–30 × 4–6, subcapitulum: length 74–77, width 60–65, hypostomal setae: *a* 7–10, *h* 7–10, *m* 4–6, adoral setae 4–8, palp: length 74–78, chelicera: length 92–96, *cha* 34–38, *chb* 22–27, epimeral setae: *1a*, *2a*, *3b*, *4a* and *4b* 5–9, genital setae: *g*<sub>1</sub>–*g*<sub>3</sub> 6–8, *g*<sub>4</sub>–*g*<sub>6</sub> 2–4, *an*<sub>1</sub> and *an*<sub>2</sub> 2–4, *ad*<sub>1</sub>–*ad*<sub>3</sub>, 4–8.



Figures 1, 2. *Flagellozetes (Cosmogalumna) macroporosa* sp. nov., adult. 1. Dorsal view; 2. Prodorsum, lateral view. Scale bars = 50  $\mu$ m.



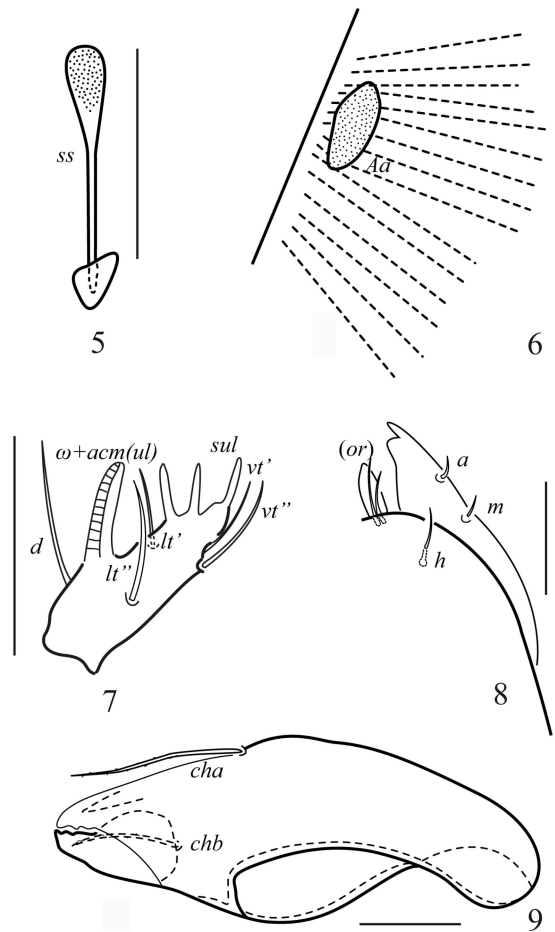
Figures 3, 4. *Flagellozetes (Cosmogalumna) macroporosa* sp. nov., adult. 3. Ventral view (gnathosoma and legs not illustrated); 4. Posterior view. Scale bars = 50  $\mu$ m.

**Integument.** Body color brown to dark brown. Middle part of prodorsum with irregular tubercles. Middle parts of notogaster and anogenital region with polygonal network. Body surface (including notogaster, epimeral region and ventral plate) densely microporose.

**Prodorsum** (Figs. 1, 2, 5). Rostrum broadly rounded. Rostral and lamellar setae setiform. Interlamellar setae absent, represented by alveoli. Bothridial setae with long stalk and oval distal head, covered by several minute barbs. Exobothridial setae and their alveoli absent. Middle part of prodorsum with irregular tubercles. Porose areas *Ad* oval, transversally oriented. Lamellar and sublamellar lines well developed; both lines parallel, curving backwards.

**Notogaster** (Figs. 1, 4, 6, 10). Anterior notogastral margin developed. Dorsophragmata of medium size, longitudinally elongated. Notogastral setae represented by 10 pairs of alveoli. Four pairs of porose areas round, with distinct borders: *Aa* largest, elongate oval; *A1* rounded; *A2* small, oval; *A3* elongate oval. Alveoli of setae *la* inserted posteriorly to *Aa*. Lyrifissures *im* located on two sides of middle part of notogaster. Opisthonotal gland openings (*gla*) located

latero-anteriorly to  $A_2$ . Median pore (*mp*) large, located to the virtual line connecting porose areas  $A_2$ .



Figures 5–9. *Flagellozetes* (*Cosmogalumna*) *macroporosa* sp. nov., adult. 5. Sensillus; 6. Radiation lines and granules near to porose area  $Aa$ ; 7. Palptarsus; 8. Left part of subcapitulum; 9. Chelicera. Scale bars = 50  $\mu\text{m}$  (Figs. 5, 6), 20  $\mu\text{m}$  (Figs. 7–9).

Gnathosoma (Figs. 3, 7–9). Subcapitulum longer than wide. Hypostomal setae *a*, *m*, *h* setiform, slightly barbed. Setae *h* and *a* longer than *m*. Two pairs of short adoral setae, setiform, curved. Palp with setation of 0–2–1–3–9 (+1 solenidion  $\omega$ ). All setae (except on tarsus) barbed. Chelicera with few blunt teeth on fixed and movable digits. Cheliceral setae long, setiform, barbed: *cha* longer than *chb*.

Epimeral region (Fig. 3). Four pairs of epimeral setae short, thin, smooth epimeral setae observed. Epimeral setal formula: 1–1–1–1.

Anogenital region (Fig. 3). Six pairs of genital setae, one pair of aggenital setae represented by alveoli. Two pairs of anal, three pairs of adanal setae setiform, smooth. Adanal lyrifissures *iad* short, thin, located lateral anteriorly to adanal setae  $ad_3$ . Postanal porose area

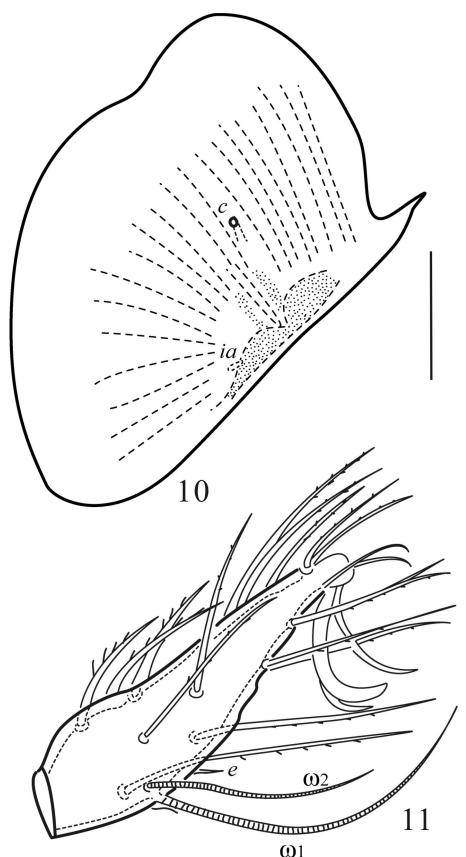
elongate oval.

Legs (Fig. 11). All legs tridactylous, lateral claws slightly thinner than median claw. Formulae of leg setation and solenidia: I (1–4–3–4–20) [1–2–2], II (1–4–3–4–15) [1–1–2], III (1–2–1–3–15) [1–1–0], IV (1–2–2–3–12) [0–1–0]; homology of setae and solenidia as indicated in Table 1.

**Table 1. Leg setation and solenidia of adult *Flagellozetes (Cosmogalumna) macroporosa* sp. nov.**

Leg	Trochanter	Femur	Genu	Tibia	Tarsus
I	v'	d, (l), bv''	(l), v', σ	(l), (v), φ <sub>1</sub> , φ <sub>2</sub>	(ft), (tc), (it), (p), (u), (a), s, (pv), v', (pl), l'', e, ω <sub>1</sub> , ω <sub>2</sub>
II	v'	d, (l), bv''	(l), v', σ	(l), (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv), ω <sub>1</sub> , ω <sub>2</sub>
III	v'	d, ev'	l', σ	l', (v), φ	(ft), (tc), (it), (p), (u), (a), s, (pv)
IV	v'	d, ev'	d, l'	l', (v), φ	ft'', (tc), (p), (u), (a), s, (pv)

Roman letters refer to normal setae (e–famulus). Greek letters refer to solenidia. A prime (') marks anterolateral setae and a double prime (") posterolateral setae of the given leg segment. Parentheses refer to a pair of setae.



Figures 10, 11. *Galumna (Cosmogalumna) macroporosa* sp. nov., adult. 10. Pteromorpha; 11. Tarsus of leg I, right, paraxial view. Scale bars = 20 μm (Fig. 10), 50 μm (Fig. 11).

**Holotype.** adult (in 75% ethanol), **China**, Shaanxi Province, Niubeiliang National Nature Reserve, in leaf litter from mixed forest, 13-VII-2009, coll. Zhanyu HU. **Paratypes.** 4 adults (75% ethanol), same data as holotype; 14 adults (75% ethanol), **China**, Guizhou Province, Kuankuoshui National Nature Reserve, in litter from secondary forest, 16-VIII-2010, coll. Keliang WU & Jiajia ZHAO.

Etymology. The specific epithet “*macroporosa*” is Latin and refers to the large porose areas *Aa* and median pore *mp*.

Remarks. This new species is morphologically most similar to *F. (C.) vladopesici* Ermilov & Corpuz-Raros, 2015, however it clearly differs from the latter by the absence of reticulate pattern on pteromorphs (versus present in *F. (C.) vladopesici*), middle part of prodorsum with irregularly tubercles (versus with longitudinal stria in *F. (C.) vladopesici*), large median pore present (versus absent in *F. (C.) vladopesici*).

***Flagellozetes (Cosmogalumna) praeoccupata* Subías, 2004**

*Cosmogalumna imperfecta* Aoki & Hu, 1993: 845; China (Yunnan).

*Galumna (Cosmogalumna) praeoccupata* Subías, 2004: 447.

*Flagellozetes (Cosmogalumna) praeoccupata* Subías, 2018: 458.

**Specimens examined.** 200 specimens, adult (in 75% ethanol), **China**, Guizhou Province, Kuankuoshui National Nature Reserve, from litter under mixed forest, 15-VIII-2010, coll. Wenqin LIANG; 85 specimens, adult (in 75% ethanol), **China**, Yunnan Province, Menglun Tropical Botanical Garden of Xishuangbanna, from leaf litter of the secondary forest, 20-II-2011, coll. Wenqin LIANG.

Distribution. China (Guizhou, Yunnan).

***Flagellozetes (Cosmogalumna) ornata* Aoki, 1988**, new record to China

*Cosmogalumna ornata* Aoki, 1988: 31.

*Galumna (Cosmogalumna) ornata* Subías, 2004: 447.

*Flagellozetes (Cosmogalumna) ornata* Ermilov & Klimov, 2018: 45.

**Specimens examined.** 3 specimens, adult (in 75% ethanol), **China**, Fujian Province, Wuyishan, from litter under mixed forest, 05-V-2013, coll. Bin LI & Bin YAN; 12 specimens, adult, **China**, Guangdong Province, Dawuling Natural Reserve, in leaf litter from the secondary forest, 20-IV-2013, coll. Meng JIAO; 16 specimens, adult, **China**, Guangdong Province, Chebaling Natural Reserve, from leaf litter of the secondary forest, 12-V-2013, coll. Meng JIAO; 25 specimens, adult, **China**, Guizhou Province, Kuankuoshui National Nature Reserve, in litter from secondary forest, 15-VIII-2010, coll. Wenqin LIANG; 5 specimens, adult, **China**, Yunnan Province, Heishan Natural Reserve, from leaf litter of the secondary forest, 15-VIII-2009, coll. Zhanyu HU; 1 specimen, adult, **China**, Yunnan Province, Gaoligongshan, in soil under the moss, 13-V-2010, coll. Yi YAN & Lixia XIE.

Distribution. China (Fujian, Guangdong, Guizhou, Yunnan); Japan.

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